

Preliminary Transmission Plans for Meeting Renewable Portfolio Standard Goals



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California ISO
Your Link to Power

RETI Stakeholder Steering Committee
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Notes on Revised July 7, 2008 Version

-  *This presentation is revised to replace the maps with new versions to meet SCE's Critical Energy Infrastructure Information requirements.*

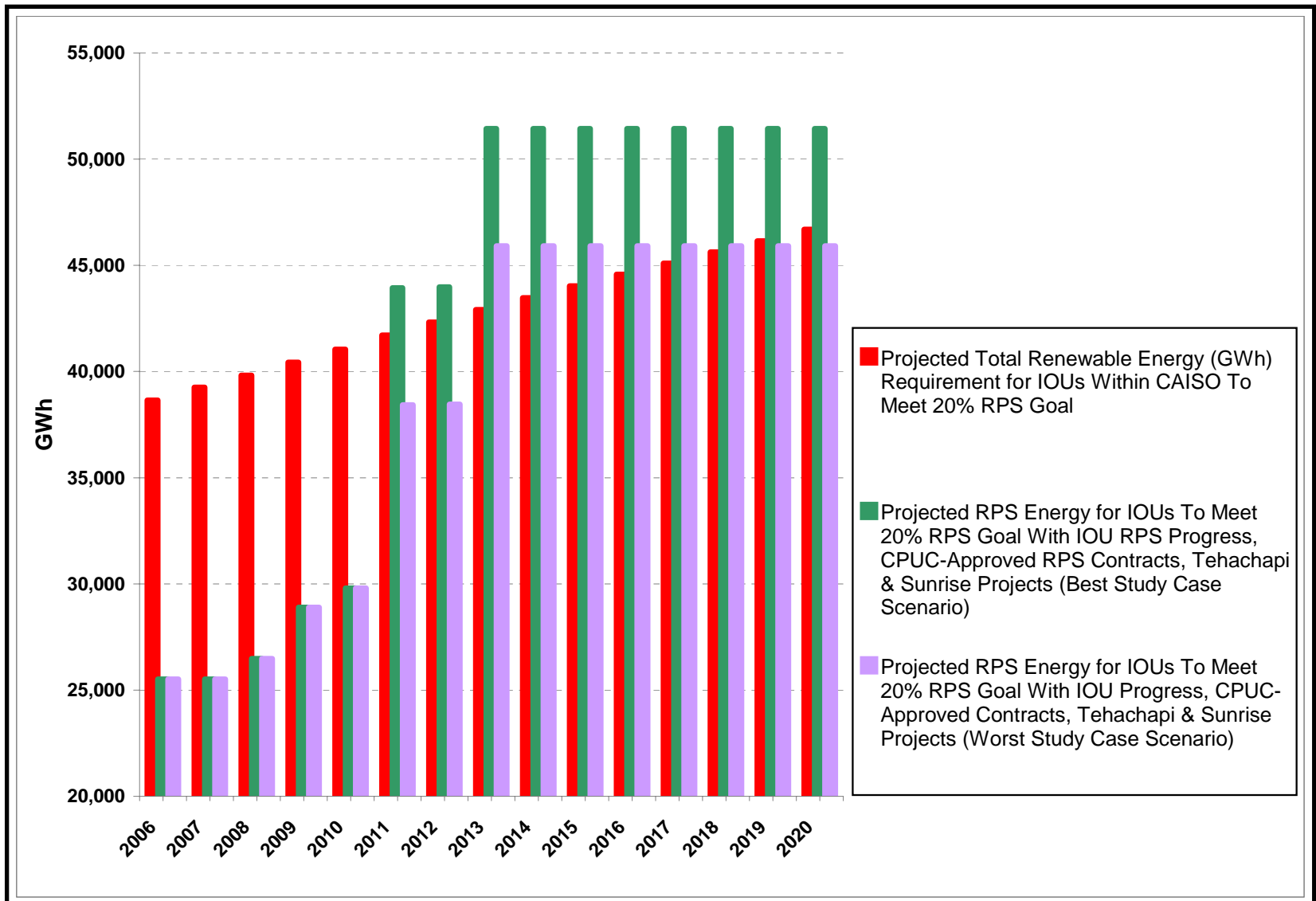
These Conceptual RPS Transmission Plans are intended to support RETI.

-  Contribute to the Renewable Energy Transmission Initiative (RETI)
-  Identify possible need for additional transmission to meet California's 20% and 33% Renewable Portfolio Standard (RPS)
-  Accelerate RETI transition from competitive renewable energy zone designations to conceptual transmission identification
-  Enable transition to Phase 2 studies by end of 2008

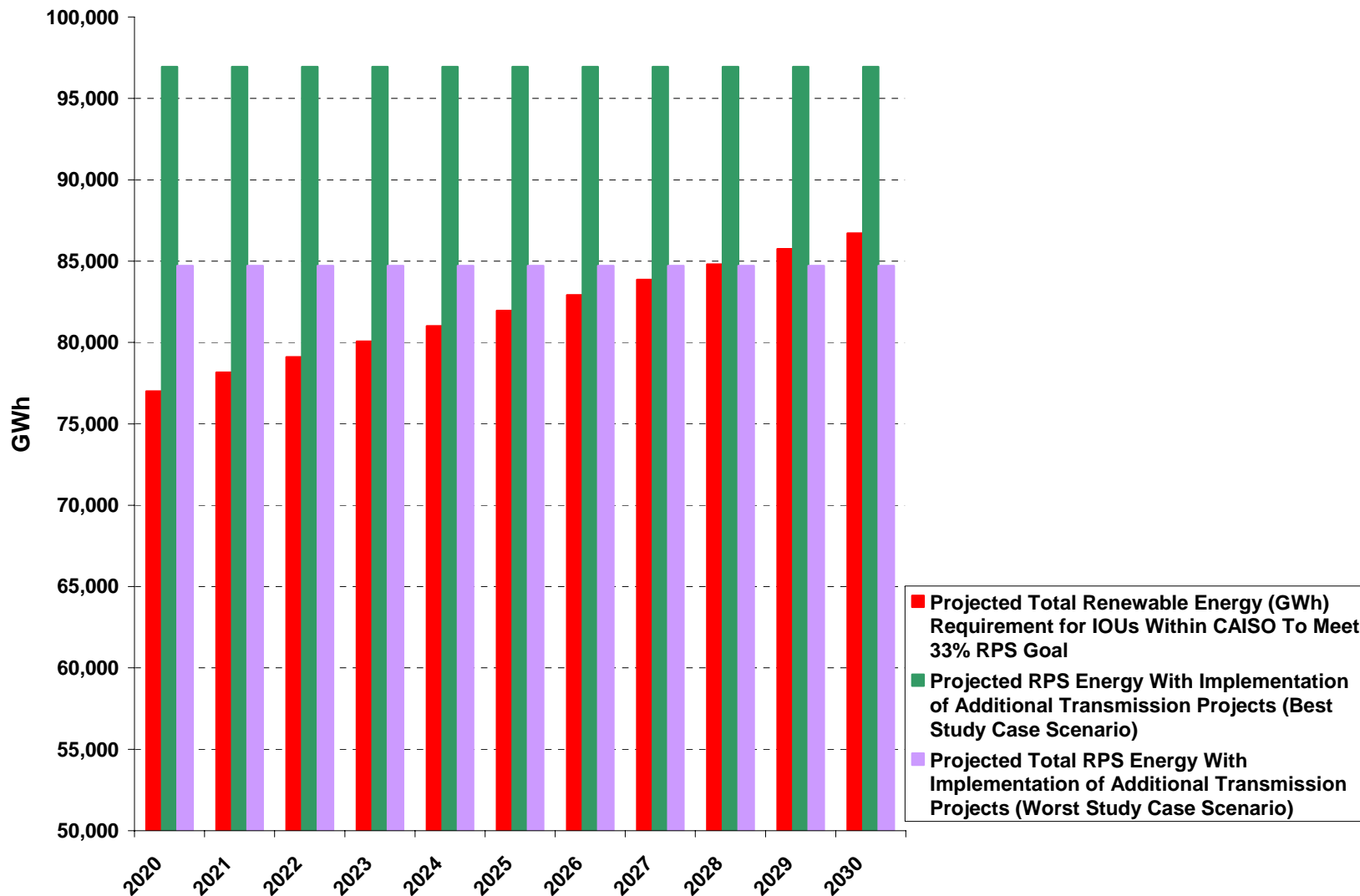
The analysis addresses three key issues.

- 🌐 Will the renewable generation tapped by the Tehachapi and Sunrise transmission projects meet the state's 20% RPS?
- 🌐 What transmission would be needed to increase solar generation on the system by 500 and 1,000 megawatts?
- 🌐 What is the magnitude of the transmission additions needed to meet California's 33% RPS?

The addition of the Tehachapi & Sunrise Projects enable California to meet 20% RPS through 2018.



Transmission in addition to Tehachapi and Sunrise is needed to meet a 33% RPS goal.



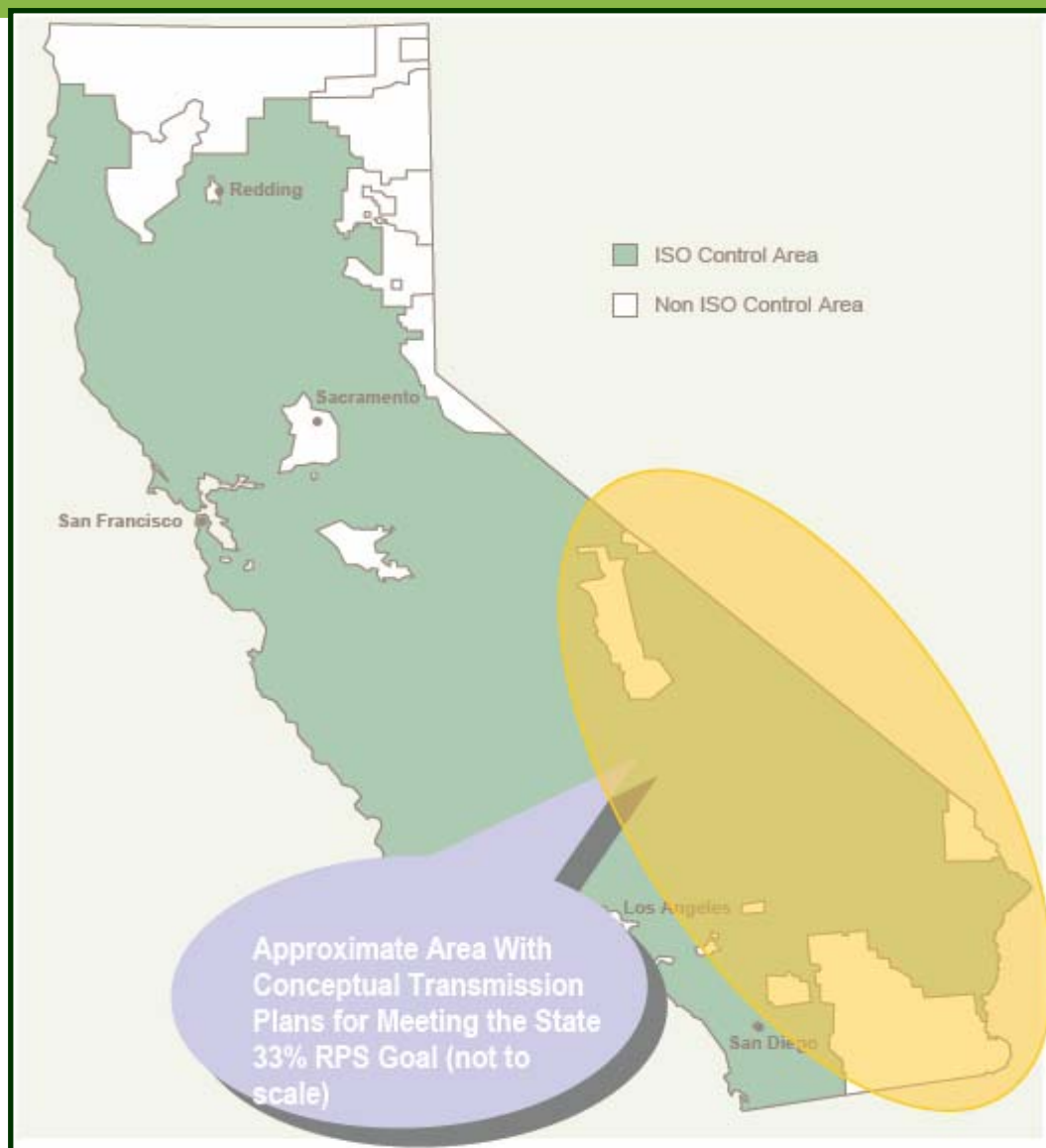
The report identifies five preliminary transmission options for connecting 500 MW and 1,000 MW of solar generation.

500 MW		1,000 MW	Notes
Option 1			
Connect via Tehachapi Project	500 MW to WindHub Substation	231 MW to Antelope-Magunden 230 kV line About 764 MW to WhirlWind Substation	Capitalizes on peaking diversity of solar and wind generation
Option 2			
Connect via Sunrise Project	512 MW to Imperial Valley Substation	600 MW to Imperial Valley Substation 375 MW to Southwest Power Link	SPS may be needed to mitigate thermal overload, though peaking diversity of solar and wind generation minimizes overloading concerns
Option 3			
Connect in the High Desert area	Potential connection to Devers Substation, requiring upgrades of the West of Devers 230kV lines		
	Convert Pisgah-Lugo 230kV Line to 500kV Line and Add a New Fourth Lugo - Rancho Vista (or Mira Loma) 500kV Line		
Option 4			
	Construct A 500 kV "locationally-constrained interconnect facility" line from Kramer Junction to Lugo Substation and Add A New Fourth Lugo - Rancho Vista (or Mira Loma) 500kV Line		
Option 5			

Transmission in addition to Tehachapi and Sunrise is needed to meet a 33% RPS goal.

- 🌐 Study identifies six 500 kV transmission lines needed to meet 33% RPS
- 🌐 Best case scenario: 33% RPS met beyond 2030
- 🌐 Worst case scenario: 33% RPS met through 2028

The Conceptual Transmission Plans for Meeting the State's 33% RPS Goal Approximate Areas of Conceptual RPS Transmission Plans are in Southern California.



These are the Conceptual Transmission Plans for Meeting the State's 33% RPS Goal Approximate Areas & Planning Level Cost Estimates.

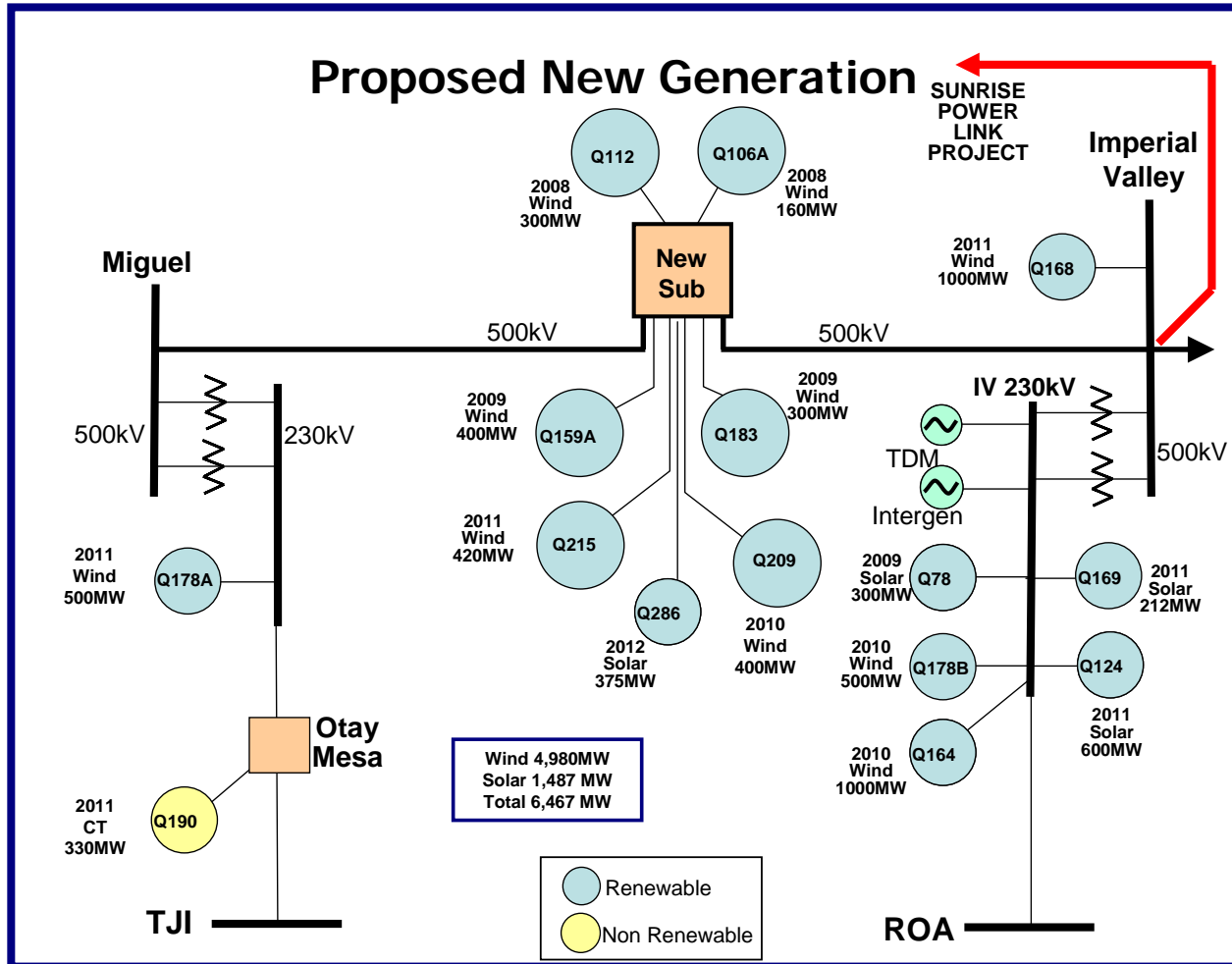
Item Number	Transmission Plan Description	Estimated Transmission Capacity (MW)	Renewable Resource Assumptions	Estimated Energy (GWh)	Planning Level Cost Estimates (+/- 50% Accuracy) (\$ Million)
1	<u>Plan A.1:</u> Construct New 500kV Substation and Loop Into Existing Southwest Powerlink Line (SWPL)	1,700 (Existing)	1,051 MW Wind	3,407	\$300 M
2	<u>Plan A.2:</u> Expand Midpoint Substation and Construct Third Midpoint – Devers and New Devers – Mira Loma (or Valley) 500kV	2,400	2,400 MW Solar 500 MW Wind (Use diversity to accommodate)	7,600	\$1,500 M
3	<u>Plan A.3:</u> Upgrade WECC Path 42 (SCE – IID) and/or Construct New 500kV LCRIF Line Connecting Additional Potential Geothermal Resources In Salton Sea to	1,800	1,800 MW Geothermal	14,200	\$800 M
4	<u>Plan A.4:</u> Central California Clean Energy Transmission Project (C3ETP) Connection of Renewable Resources in the Kern County Area	1,250	1,250 MW Wind	4,052	\$1,600 M
5	<u>Plan A.5:</u> Converting Pisgah – Lugo 230kV Lines to 500kV Double Circuit Tower Line (DCTL) OR +/- 500kV DC Line And Adding A New Fourth Lugo – Rancho Vista (or Mira Loma) 500kV Line	1,200	1,200 MW Solar	2,838 – 9,500	\$1,600 M
6	<u>Plan A.6:</u> Construct A New 500kV LCRIF Line to Kramer Jct. and Lugo Substation	1,200	1,200 MW Wind	6,700	\$650 M
Total		9,550 MW	9,401 MW	38,800 - 45,500 GWh	\$6,450 M Or \$6.5 B

Resources in Renewable Rich Areas

	Resource Type And Locations	Estimated Total Developable Capacity (MW)	Resource Assumptions for Tehachapi Transmission and Sunrise Powerlink Projects (MW)
1	Wind – Tehachapi Area	8,035	3,700 – 4,500 (Tehachapi)
2	Wind – Imperial Valley	1,051	1,000 (See Scenario 1, Chapter I)
3	Wind – Eastern Mojave	1,994	0
4	Wind – Western Mojave	3,810	0
5	Solar – Imperial County	220,244	1,000 (See Scenario 3, Chapter I)
6	Solar – San Bernardino County	381,159	0
7	Solar – Riverside County	127,161	0
8	Geothermal – Imperial County (Most Likely Development)	2,488 (Existing 523)	1,000 (See Scenario 2, Chapter I)
9	Geothermal – State of Nevada	1,248 (most likely incremental)	0

(Data from Various Public CEC Staff Reports)

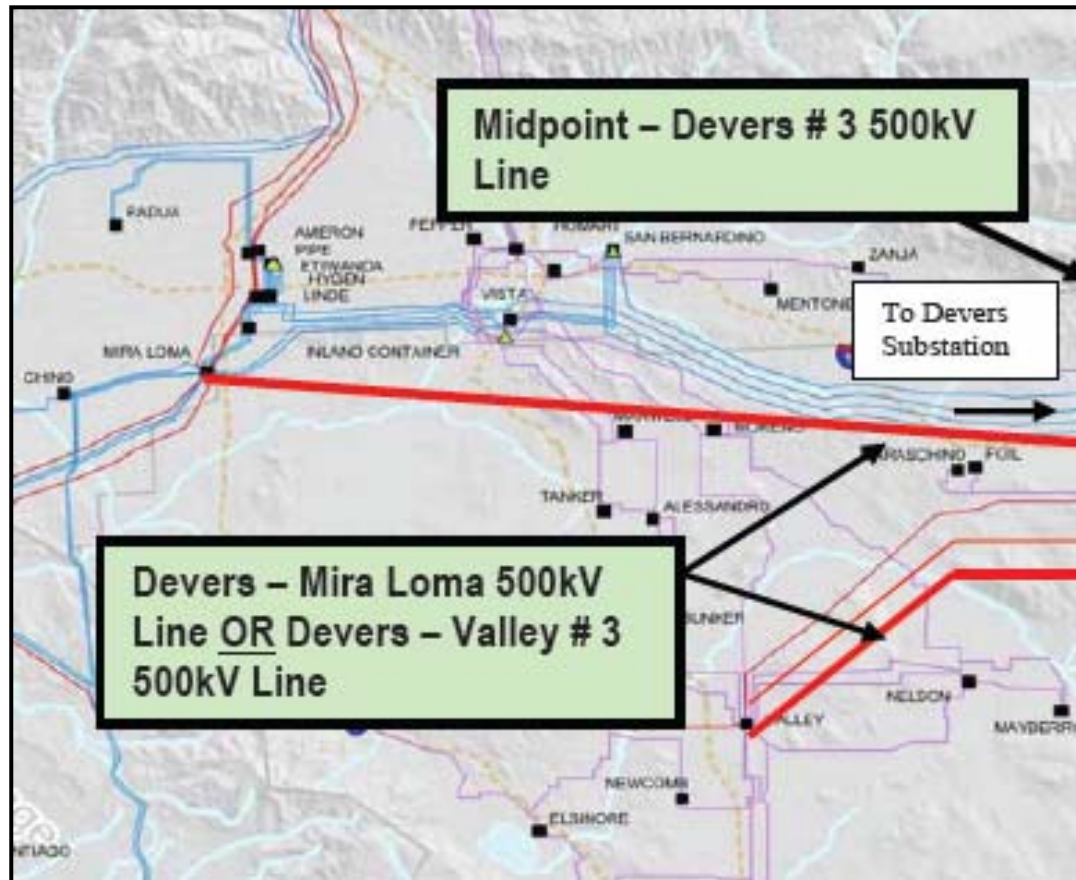
Construct New Substation and Loop Into Existing Southwest Powerlink Line



- Construct New 500kV Substation and Loop Into Existing Southwest Powerlink Line
- Connect about 1,051 MW of wind generation

Preliminary Conceptual Plan

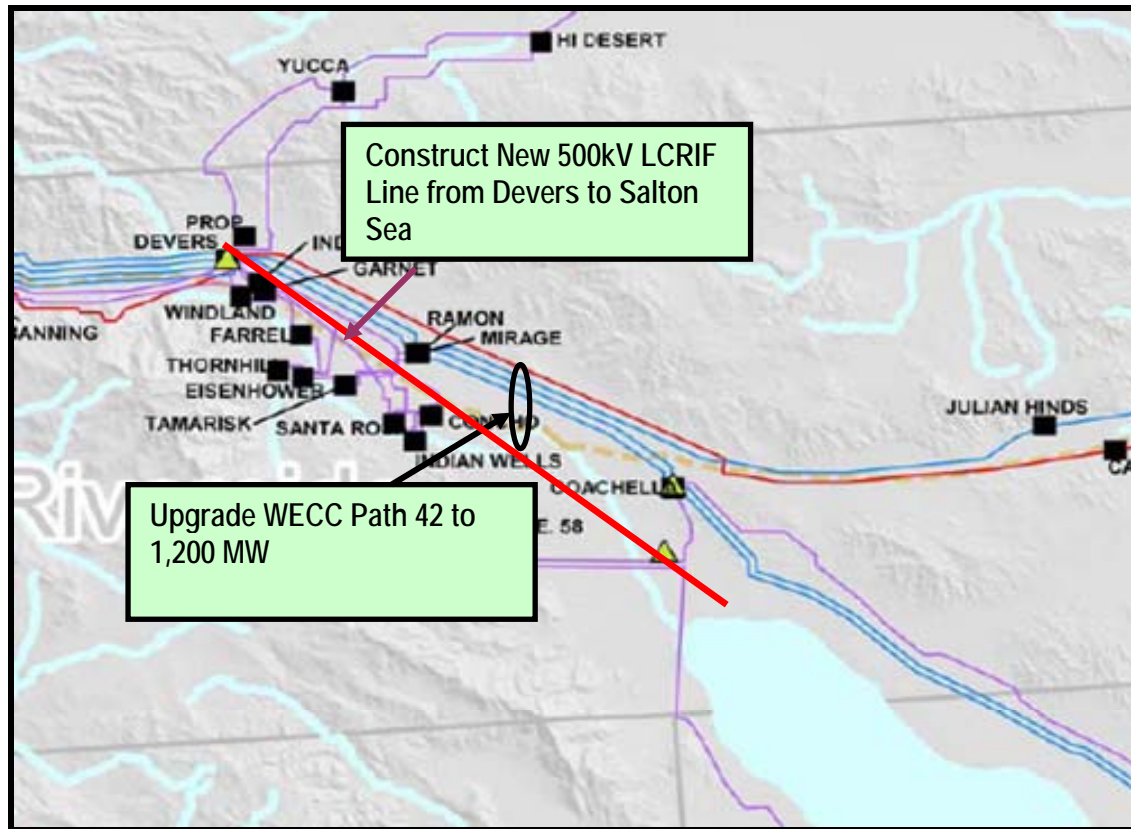
Expand Midpoint Substation and Construct Two New 500kV Lines



- Expand Midpoint Substation and Construct Third Midpoint – Devers and Devers – Mira Loma (or Valley) 500kV Line
- Connect approximately 2,400 MW solar generation and 500 MW wind generation (resource diversity that peaks at different times)

Preliminary Conceptual Plan

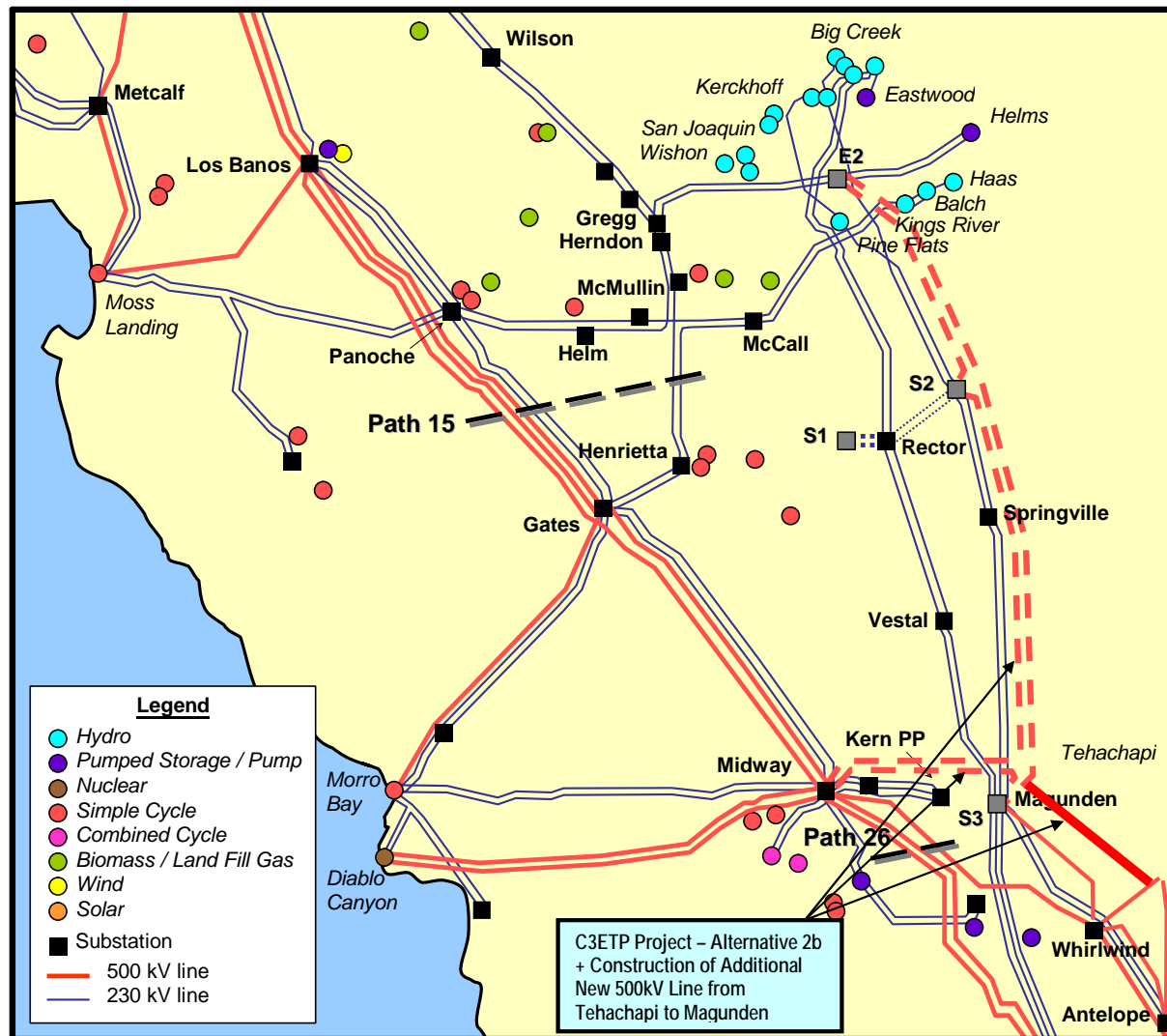
Upgrade WECC Path 42 and/or Construct New 500kV Line



- Upgrade WECC Path 42 (SCE – IID) and/or Construct New 500kV LCRIF from Salton Sea to Devers Substation
- Connect 1,800 MW geothermal generation in the Salton Sea

Preliminary Conceptual Plan

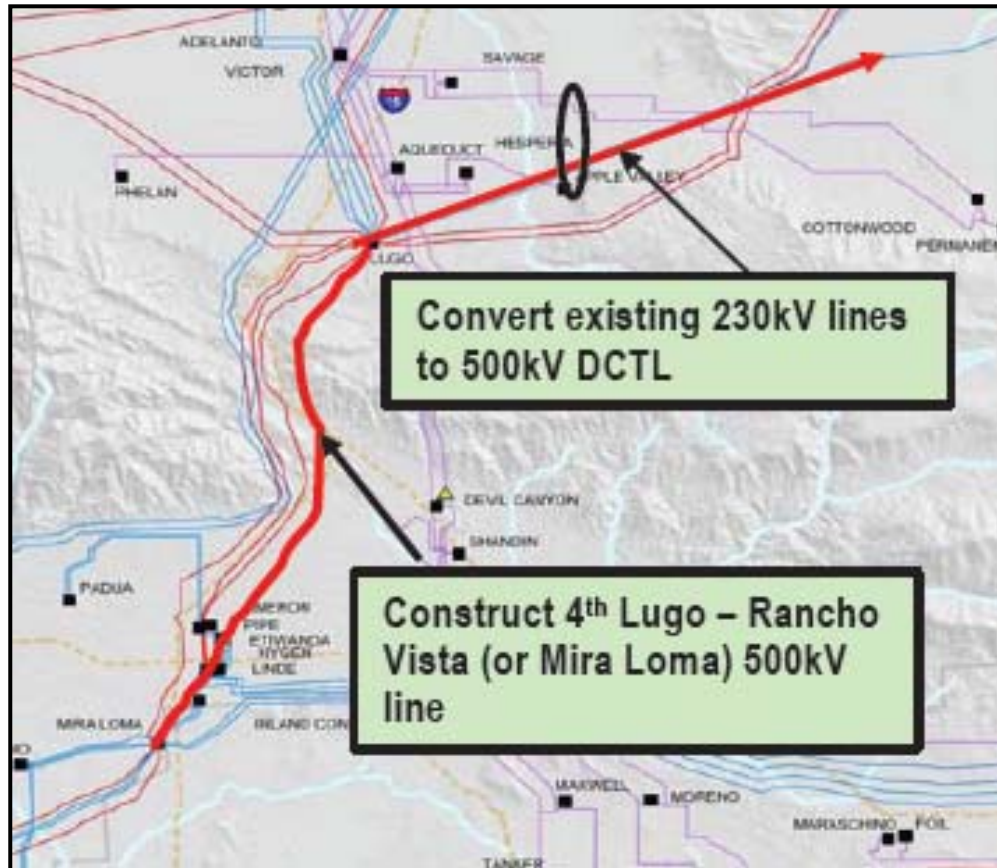
Construct Central California Clean Energy Transmission Project and New 500kV Line to Tehachapi Area



- Central California Clean Energy Transmission Project (C3ETP) and New 500kV Line from Tehachapi to Magunden
- Connect about 1,250 MW of wind resources in Kern County

Preliminary Conceptual Plan

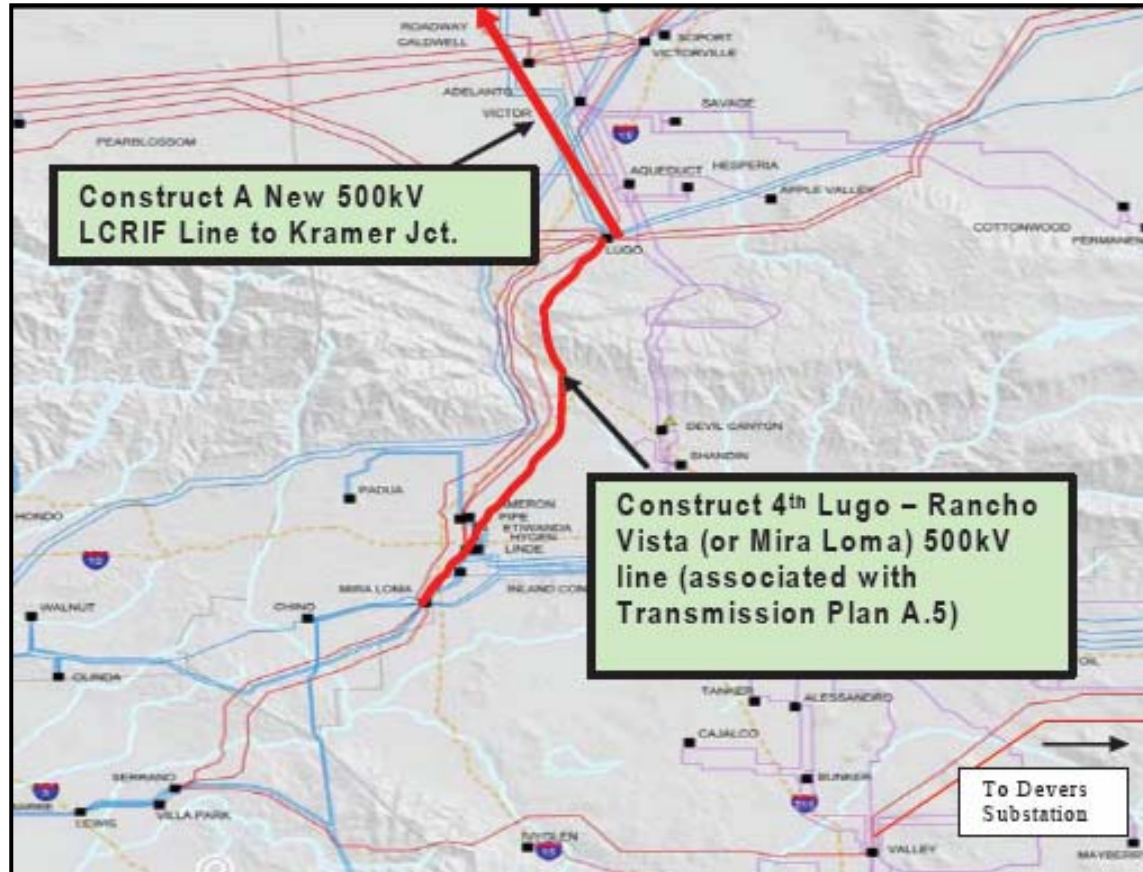
Convert 230kV Lines to 500kV Lines and Add A Fourth South of Lugo 500kV Line



- Convert Pisgah – Lugo 230kV Lines to 500kV Double Circuit Tower Line or +/- 500kV DC line
- Add a New Fourth Lugo – Rancho Vista (or Mira Loma) 500kV line
- Connect 1,200 MW of solar generation

Preliminary Conceptual Plan

Construct New 500kV Line North of Lugo Substation



Preliminary Conceptual Plan

- Construct New 500kV LCRIF line North of Lugo Substation
- Construct New 500kV Line to Lugo Substation (this is proposed as part of Transmission Plan on page 15)
- Connect 1,200 MW of wind generation

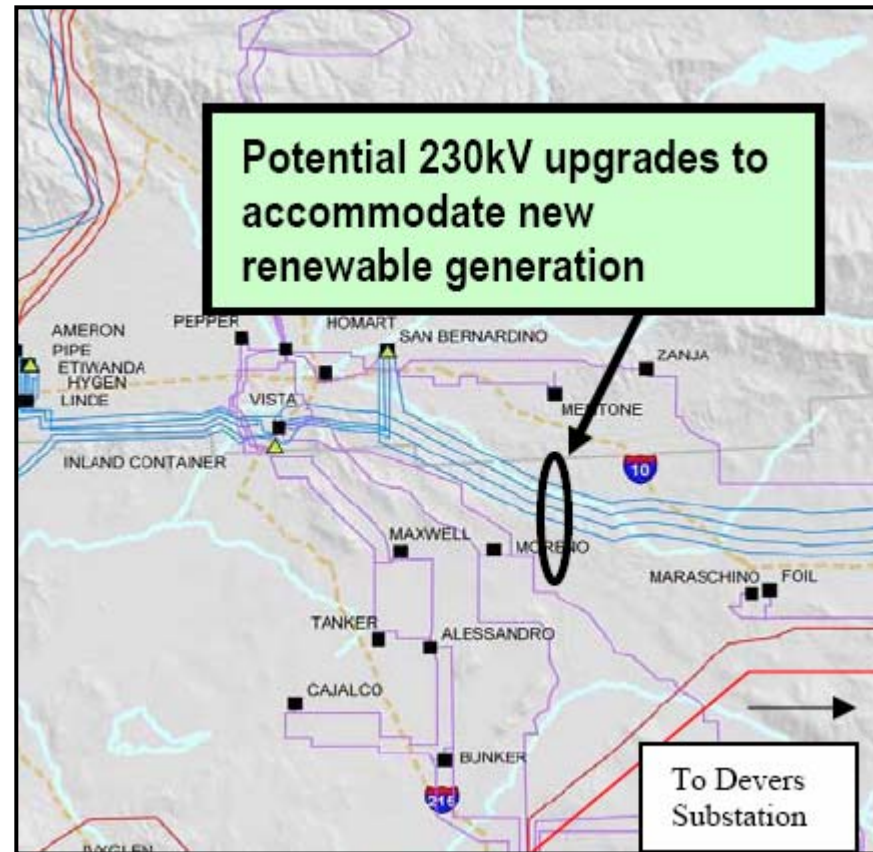
Supplemental Slides

Preliminary Transmission Plans to Connect 500 MW and 1,000 MW Solar Generation (cont'd)

- 🌐 Option 1 – Connecting 500 MW and 1,000 MW of solar generation to Tehachapi Transmission Project utilizing diversity between solar and wind generation resources
 - Potential connection of 500 MW to WindHub Substation
 - Potential connection of 1,000 MW
 - 231 MW connecting to the Antelope – Magunden 230kV line
 - Approximately 764 MW connecting to the WhirlWind Substation
- 🌐 Option 2 – Connecting 500 MW and 1,000 MW of solar generation to the Sunrise Powerlink Project
 - Potential connection of 512 MW of solar generation to Imperial Valley Substation
 - Potential connection of 1,000 MW
 - 600 MW solar generation connecting to Imperial Valley Substation
 - 375 MW solar generation connecting to SWPL line
 - SPS may be needed to mitigate thermal overload additional generation is connected
 - Diversity between solar and wind resources minimize overloading concerns since they peak at different times

Preliminary Transmission Plans to Connect 500 MW and 1,000 MW Solar Generation (cont'd)

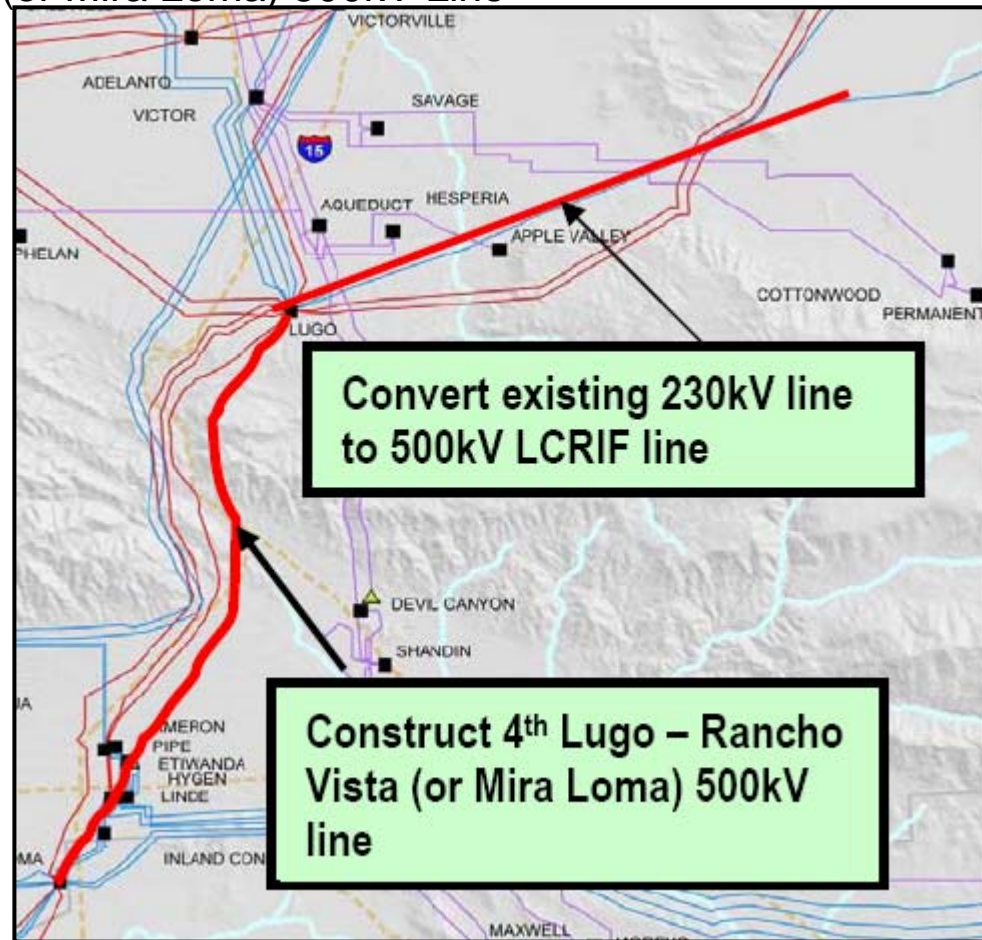
- Option 3 – Connect 500 MW and 1,000 MW of solar generation in the High Desert Area
Connecting 500 MW and 1,000 MW of solar generation in the High Desert Area
 - Potential connection to Devers Substation, requiring upgrades of the West of Devers 230kV lines



Preliminary Conceptual Plan

Preliminary Transmission Plans to Connect 500 MW and 1,000 MW Solar Generation (cont'd)

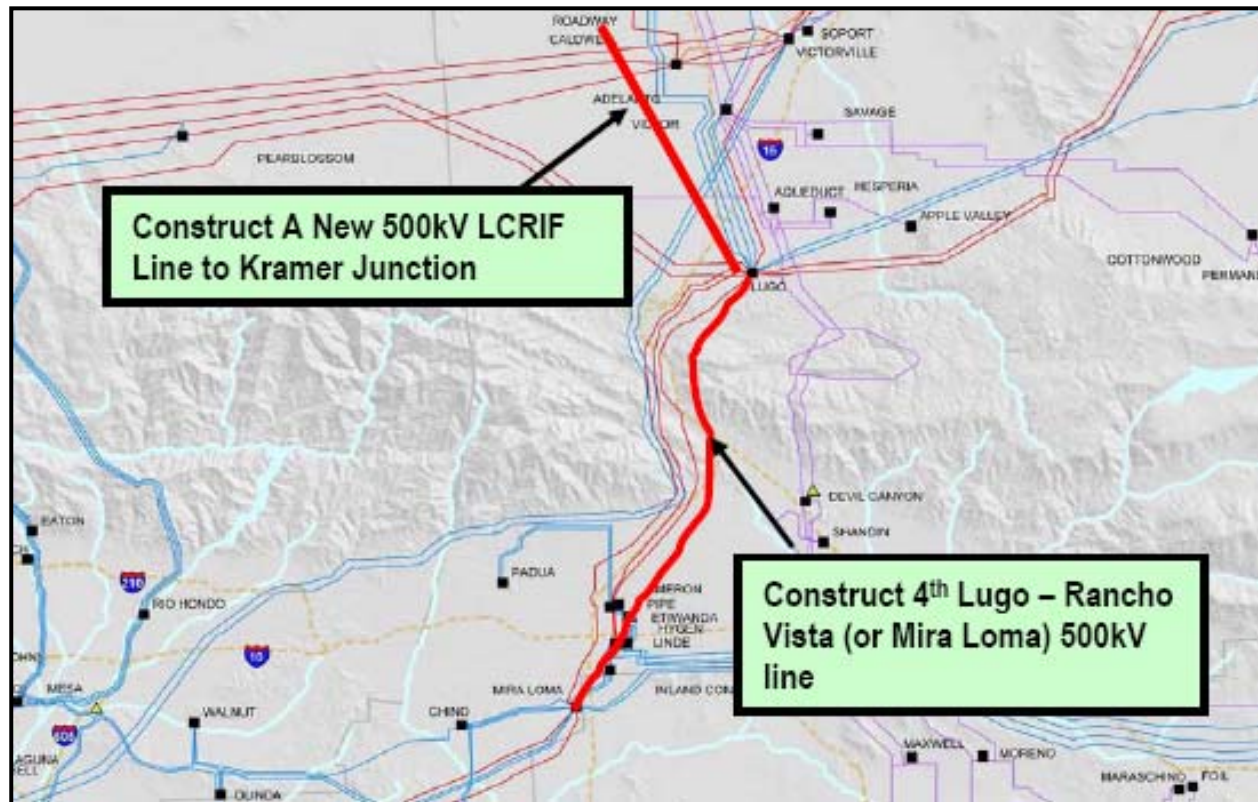
- Option 4 – Convert Pisgah-Lugo 230kV Line to 500kV Line and Adding a New Fourth Lugo – Rancho Vista (or Mira Loma) 500kV Line



Preliminary Conceptual Plan

Preliminary Transmission Plans to Connect 500 MW and 1,000 MW Solar Generation (cont'd)

- Option 5 – Construct A 500 kV LCRIF line from Kramer Junction to Lugo Substation and Add A New Fourth Lugo – Rancho Vista (or Mira Loma) 500kV Line



**Preliminary
Conceptual
Plan**